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# Echo Reservoir
# Summit County, Utah

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

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# U.S. ENVIRONMENTAL PROTECTION AGENCY
# NATIONAL EUTROPHICATION SURVEY

## WORKING PAPER SERIES

**CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON**

**and**

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# REPORT
# ON
# ECHO RESERVOIR
# SUMMIT COUNTY
# UTAH

EPA REGION VIII

WORKING PAPER No. 838

WITH THE COOPERATION OF THE

UTAH STATE DIVISION OF HEALTH

AND THE

UTAH NATIONAL GUARD

OCTOBER, 1977

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
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# FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

## OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

## ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

## LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Utah Department of Social Services and the Utah Department of Natural Resources for professional involvement, to the Utah National Guard for conducting the tributary sampling phase of the Survey, and to those Utah wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staffs of the Bureau of Water Quality of the Division of Health and the Division of Wildlife Resources provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

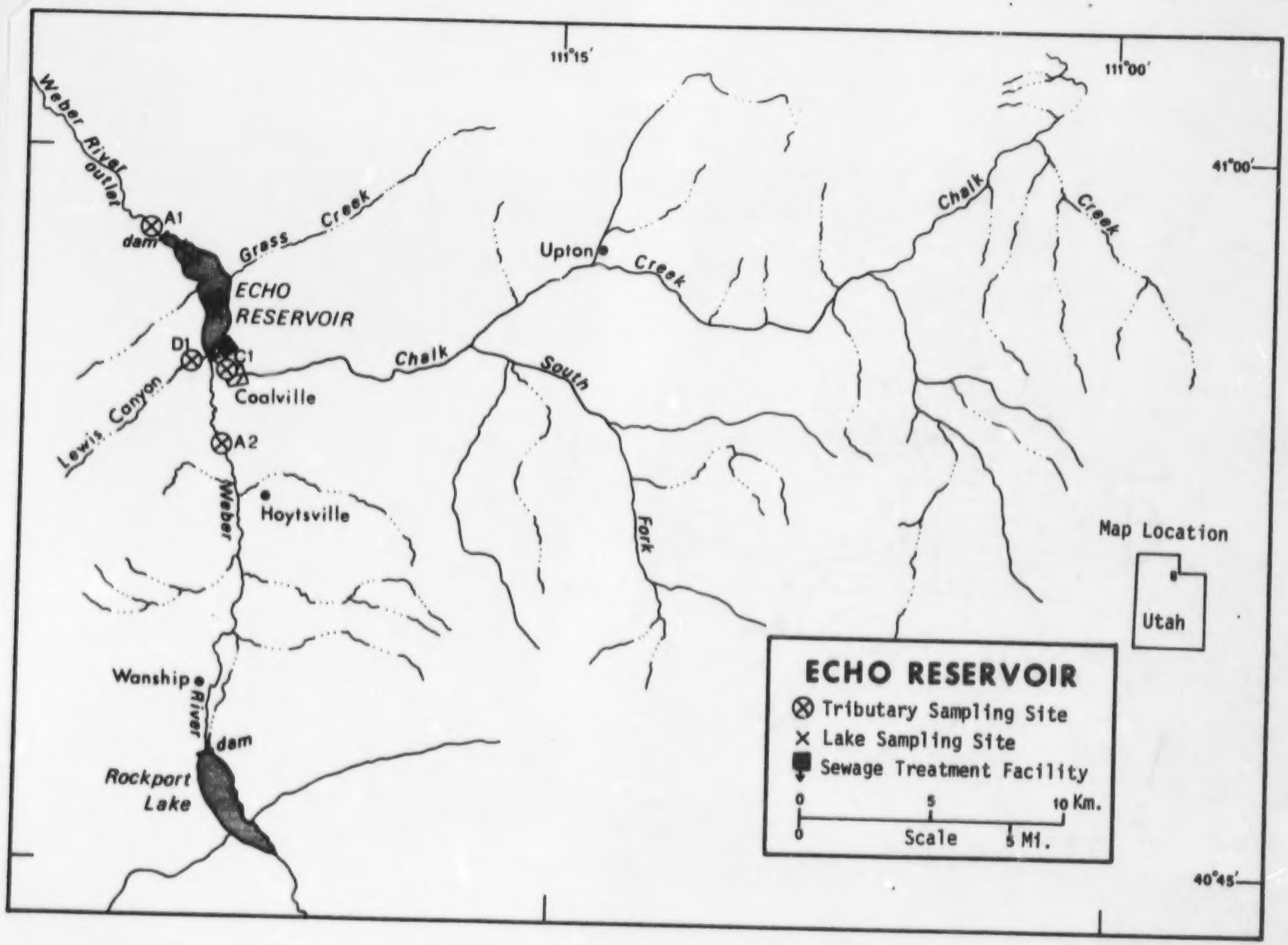
Major General Maurice L. Watts, the Adjutant General of Utah, and Project Officer Lt. Colonel T. Ray Kingston, who directed the volunteer efforts of the Utah National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

# NATIONAL EUTROPHICATION SURVEY

## STUDY LAKES AND RESERVOIRS

### STATE OF UTAH

| NAME | COUNTY |
|---|---|
| Bear | Rich, UT; Bear Lake, ID |
| Deer Creek | Wasatch |
| Echo | Summit |
| Fish | Sevier |
| Flaming Gorge | Daggett, UT; Sweetwater, WY |
| Huntington | Emery |
| Joes Valley | Emery |
| Lower Bowns | Garfield |
| Lynn | Box Elder |
| Minersville | Beaver |
| Moon | Duchesne |
| Navajo | Kane |
| Newcastle | Iron |
| Otter Creek | Piute |
| Panguich | Garfield |
| Pelican | Uintah |
| Pineview | Weber |
| Piute | Piute |
| Porcupine | Cache |
| Powell | Garfield, Kane, San Juan, UT; Coconino, AZ |
| Pruess | Millard |
| Sevier Bridge | Juab, Sanpete |
| Starvation | Duchesne |
| Steinaker | Uintah |
| Tropic | Garfield |
| Utah | Utah |
| Willard Bay | Box Elder |


111°15'
111°00'
41°00'
40°45'
Weber River outlet
dam
A1
Grass Creek
ECHO RESERVOIR
D1
C1
Coalville
Lewis Canyon
A2
Weber
Hoytsville
Chalk
South
Fork
Upton
Creek
Chalk
Creek
Wanship
River
dam
Rockport Lake
Map Location
Utah
ECHO RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0
5
10 Km.
0
Scale
5 Mi.

ECHO RESERVOIR

STORET NO. 4904

## I. CONCLUSIONS

### A. Trophic Condition

Survey data indicate that Echo Reservoir is eutrophic. It ranked twenty-sixth in overall trophic quality when the 27 Utah lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Eighteen of the water bodies had less and one had the same median total phosphorus, 22 had less and one had the same median dissolved orthophosphorus, 19 had less median inorganic nitrogen, 13 had less mean chlorophyll a, and 21 had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at sampling station 1 in August and September.

### B. Rate-Limiting Nutrient:

The algal assay results are not considered representative of conditions in the reservoir at the times the samples were collected. However, the reservoir data indicate nitrogen limitation at both stations in May and September and at station 1 in August. Phosphorus limitation is indicated at station 2 in August.

### C. Nutrient Controllability:

1. Point sources--It is calculated that the only known point source contributed 25.4% of the total phosphorus load to Echo Reservoir during the sampling year.

* See Appendix A.

The present phosphorus loading of 2.50 $g/m^2/yr$ is twice that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11). While even complete removal of phosphorus at the Coalville wastewater treatment plant would still leave a loading of 1.87 $g/m^2/yr$, it is possible that a high degree of phosphorus control at the plant would result in persistent phosphorus limitation in the reservoir and at least some improvement in trophic condition.

2. Non-point sources--It is estimated that non-point sources contributed 74.6% of the total phosphorus load to the reservoir during the sampling year. The Weber River contributed 53.7% of the total load; Chalk Creek, 11.8%; and the minor tributaries and immediate drainage contributed an estimated 6.2%.

## II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

### A. Morphometry††:

1. Surface area: 5.95 kilometers$^2$.
2. Mean depth: 15.3 meters.
3. Maximum depth: 33.5 meters.
4. Volume: 91.278 x $10^6$ $m^3$.
5. Mean hydraulic retention time: 134 days (based on outflow).

### B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

| Name | Drainage area ($km^2$)* | Mean flow ($m^3$/sec)* |
|---|---|---|
| Weber River | 1,134.4 | 5.640 |
| Chalk Creek | 655.3 | 1.740 |
| Unnamed Creek D-1 | 15.5 | 0.080 |
| Minor tributaries & immediate drainage - | 84.7 | 0.227 |
| Totals | 1,889.9 | 7.687 |

2. Outlet -

| | | |
|---|---|---|
| Weber River | 1,895.9** | 7.860 |

### C. Precipitation***:

1. Year of sampling: 42.0 centimeters.
2. Mean annual: 35.1 centimeters.

---

† Table of metric conversions--Appendix B.
†† Sudweeks, 1974; Anonymous, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of reservoir.
*** See Working Paper No. 175.

## III. WATER QUALITY SUMMARY

Echo Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two or more depths at two stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 24.4 meters at station 1 and 8.5 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR ECHO RESERVOIR
STORET CODE 4904

| PARAMETER | 1ST SAMPLING ( 5/12/75) 2 SITES RANGE | MEAN | MEDIAN | 2ND SAMPLING ( 8/ 7/75) 2 SITES RANGE | MEAN | MEDIAN | 3RD SAMPLING ( 9/18/75) 2 SITES RANGE | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| TEMP (C) | 6.6 - 9.6 | 8.3 | 9.3 | 10.3 - 22.0 | 18.0 | 18.4 | 13.0 - 14.9 | 14.2 | 14.2 |
| DISS OXY (MG/L) | 9.2 - 10.4 | 9.9 | 10.0 | 1.0 - 11.2 | 5.6 | 5.2 | 1.6 - 7.8 | 5.6 | 6.5 |
| CNDCTVY (MCROMO) | 451. - 502. | 467. | 455. | 265. - 297. | 287. | 292. | 310. - 341. | 334. | 338. |
| PH (STAND UNITS) | 8.3 - 8.5 | 8.4 | 8.4 | 8.2 - 8.9 | 8.6 | 8.5 | 7.9 - 8.5 | 8.2 | 8.3 |
| TOT ALK (MG/L) | 188. - 266. | 224. | 222. | 140. - 181. | 153. | 151. | 170. - 175. | 172. | 172. |
| TOT P (MG/L) | 0.035 - 0.144 | 0.065 | 0.051 | 0.016 - 0.199 | 0.046 | 0.027 | 0.038 - 0.137 | 0.064 | 0.049 |
| ORTHO P (MG/L) | 0.016 - 0.041 | 0.022 | 0.017 | 0.005 - 0.170 | 0.026 | 0.006 | 0.005 - 0.027 | 0.012 | 0.006 |
| NO2+NO3 (MG/L) | 0.060 - 0.160 | 0.101 | 0.110 | 0.020 - 0.260 | 0.086 | 0.035 | 0.030 - 0.200 | 0.091 | 0.060 |
| AMMONIA (MG/L) | 0.020 - 0.050 | 0.033 | 0.030 | 0.100 - 0.530 | 0.220 | 0.185 | 0.020 - 0.030 | 0.025 | 0.025 |
| KJEL N (MG/L) | 0.300 - 0.700 | 0.471 | 0.400 | 0.300 - 0.600 | 0.420 | 0.400 | 0.200 - 0.400 | 0.275 | 0.250 |
| INORG N (MG/L) | 0.08[illegible] - 0.210 | 0.134 | 0.130 | 0.120 - 0.790 | 0.306 | 0.280 | 0.060 - 0.230 | 0.116 | 0.080 |
| TOTAL N (MG/L) | 0.410 - 0.760 | 0.573 | 0.560 | 0.320 - 0.860 | 0.506 | 0.470 | 0.230 - 0.600 | 0.366 | 0.345 |
| CHLRPYL A (UG/L) | 8.5 - 13.4 | 10.9 | 10.9 | 4.2 - 4.7 | 4.4 | 4.4 | 2.6 - 8.4 | 5.5 | 5.5 |
| SECCHI (METERS) | 0.4 - 0.6 | 0.5 | 0.5 | 1.8 - 1.8 | 1.8 | 1.8 | 1.1 - 1.8 | 1.5 | 1.5 |

B. Biological Characteristics:

1. Phytoplankton -

| Sampling Date | Dominant Genera | Algal Units per ml |
|---|---|---|
| 05/12/75 | 1. Chroomonas (?) sp. | 9,336 |
| | 2. Centric diatoms | 1,221 |
| | 3. Fragilaria sp. | 1,103 |
| | 4. Cryptomonas sp. | 906 |
| | 5. Asterionella sp. | 118 |
| | Total | 12,684 |
| 08/07/75 | 1. Chroomonas (?) sp. | 305 |
| | 2. Cryptomonas sp. | 153 |
| | 3. Fragilaria sp. | 61 |
| | 4. Asterionella sp. | 31 |
| | 5. Ankistrodesmus sp. | 31 |
| | Total | 581 |
| 09/18/75 | 1. Fragilaria sp. | 918 |
| | 2. Chroomonas (?) sp. | 598 |
| | 3. Cryptomonas sp. | 160 |
| | 4. Aphanizomenon sp. | 40 |
| | 5. Asterionella sp. | 40 |
| | Total | 1,756 |

2. Chlorophyll a -

| Sampling Date | Station Number | Chlorophyll a (µg/l) |
|---|---|---|
| 05/12/75 | 1 | 8.5 |
| | 2 | 13.4 |
| 08/07/75 | 1 | 4.2 |
| | 2 | 4.7 |
| 09/18/75 | 1 | 2.6 |
| | 2 | 8.4 |

C. Limiting Nutrient Study:

Significant nutrient changes occurred in the samples during shipment from the field to the laboratory, and the algal assay results are not considered representative of conditions in the reservoir at the times the samples were taken (05/12/75 and 09/18/75).

The reservoir data indicate nitrogen limitation at both sampling stations in May and September; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 10/1 or less, and nitrogen limitation would be expected. The August data indicate nitrogen limitation at station 1 but phosphorus limitation at station 2 (the mean N/P ratios were 8/1 and 27/1, respectively).

Nitrogen limitation, as indicated by the in-reservoir nitrogen to phosphorus ratios, does not necessarily mean that the trophic condition of the reservoir can be improved by controlling nitrogen inputs. In many cases, the apparent condition of nitrogen-limitation results from excessive phosphorus input from point sources and is often accompanied by a corresponding increase in primary production. In such cases, the reversal of the enriched condition depends upon phosphorus control, not nitrogen control.

## IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Utah National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v). Sampling was begun in November, 1974, and was completed in May, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Utah District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in the unnamed stream at station D-1 and the mean annual ZZ flow.

The operator of the Coalville wastewater treatment plant provided monthly effluent samples, and corresponding flow data were provided by S. E. Sowby, Mountainland Association of Governments, Provo.

A. Waste Sources:

1. Known municipal* -

| Name | Pop. Served | Treatment | Mean Flow ($m^3/d$) | Receiving Water |
|---|---|---|---|---|
| Coalville | 1,000 | tr. filter | 660.3** | Echo Reservoir |

2. Known industrial - None

---

* Hopkins, 1975.
** Sowby, 1977.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

| Source | kg P/ yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Weber River | 8,005 | 53.7 |
| Chalk Creek | 1,755 | 11.8 |
| Unnamed Creek D-1 | 325 | 2.2 |
| b. Minor tributaries & immediate drainage (non-point load) - | 925 | 6.2 |
| c. Known municipal STP's - | | |
| Coalville | 3,785 | 25.4 |
| d. Septic tanks - Unknown | ? | - |
| e. Known industrial - None | - | - |
| f. Direct precipitation* - | 105 | 0.7 |
| Total | 14,900 | 100.0 |

2. Outputs -

Reservoir outlet - Weber River 10,165

3. Net annual P accumulation - 4,735 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

| Source | kg N/yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Weber River | 215,390 | 68.0 |
| Chalk Creek | 64,585 | 20.4 |
| Unnamed Creek D-1 | 5,140 | 1.6 |
| b. Minor tributaries & immediate drainage (non-point load) - | 14,580 | 4.6 |
| c. Known municipal STP's - | | |
| Coalville | 10,495 | 3.3 |
| d. Septic tanks - Unknown | ? | - |
| e. Known industrial - None | - | - |
| f. Direct precipitation* - | 6,425 | 2.1 |
| Total | 316,615 | 100.0 |

2. Outputs -

Reservoir outlet - Weber River 178,965

3. Net annual N accumulation - 137,650 kg.

D. Non-point Nutrient Export by Subdrainage Area:

| Tributary | kg P/km²/yr | kg N/km²/yr |
|---|---|---|
| Weber River | 7 | 190 |
| Chalk Creek | 3 | 99 |
| Unnamed Creek D-1 | 21 | 332 |

* See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

| | Total Phosphorus | | Total Nitrogen | |
|---|---|---|---|---|
| | Total | Accumulated | Total | Accumulated |
| grams/$m^2$/yr | 2.50 | 0.80 | 53.2 | 23.1 |

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Echo Reservoir:

| | |
|---|---|
| "Dangerous" (eutrophic loading) | 1.22 |
| "Permissible" (oligotrophic loading) | 0.61 |

## V. LITERATURE REVIEWED

Anonymous, 1975. Water resources data for Utah. Part 1. Surface water records. U.S. Geol. Surv., Salt Lake City.

Hopkins, Clyde M., 1975. Treatment plant questionnaire. UT Bur. of Env. Health, Salt Lake City.

Sowby, Stephen E., 1977. Personal communication (corrected flow data for Coalville STP). Mountainland Assoc. of Govts., Provo.

Sudweeks, Calvin K., 1975. Personal communication (reservoir morphometry). UT Bur. of Env. Health, Salt Lake City.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

# VI. APPENDICES

## APPENDIX A

## LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500-MEAN SEC | MEAN CHLORA | 15-MIN DO | MEDIAN DISS ORTHO P |
|---|---|---|---|---|---|---|---|
| 0408 | LAKE POWELL | 0.010 | 0.410 | 339.830 | 3.081 | 13.800 | 0.007 |
| 4901 | BEAR LAKE | 0.011 | 0.040 | 253.167 | 0.945 | 9.200 | 0.003 |
| 4902 | LOWER BOWN'S RESERVOIR | 0.031 | 0.040 | 336.000 | 5.567 | 9.400 | 0.006 |
| 4903 | DEER CREEK RESERVOIR | 0.038 | 0.215 | 430.333 | 9.078 | 14.800 | 0.006 |
| 4904 | ECHO RESERVOIR | 0.047 | 0.170 | 450.333 | 6.967 | 14.000 | 0.012 |
| 4905 | LYNN RESERVOIR | 0.121 | 0.200 | 417.667 | 39.600 | 10.400 | 0.052 |
| 4906 | FISH LAKE | 0.023 | 0.040 | 152.000 | 12.483 | 10.400 | 0.004 |
| 4907 | HUNTINGTON NORTH RESERVO | 0.013 | 0.040 | 392.000 | 1.900 | 7.800 | 0.005 |
| 4908 | JOE'S VALLEY RESERVOIR | 0.012 | 0.045 | 400.000 | 2.483 | 11.200 | 0.003 |
| 4909 | MINERSVILLE RESERVOIR | 0.192 | 0.060 | 445.000 | 33.583 | 8.600 | 0.107 |
| 4910 | MOON LAKE | 0.008 | 0.040 | 381.000 | 2.700 | 9.600 | 0.002 |
| 4911 | NAVAJO LAKE | 0.016 | 0.040 | 368.000 | 2.000 | 6.000 | 0.003 |
| 4912 | NEWCASTLE RESERVOIR | 0.051 | 0.040 | 428.667 | 12.467 | 13.600 | 0.009 |
| 4913 | OTTER CREEK RESERVOIR | 0.067 | 0.040 | 453.667 | 11.767 | 10.600 | 0.033 |
| 4914 | PANGUITCH LAKE | 0.071 | 0.040 | 426.500 | 45.950 | 14.200 | 0.010 |
| 4915 | PELICAN LAKE | 0.044 | 0.050 | 438.500 | 6.350 | 8.400 | 0.004 |
| 4916 | PINEVIEW RESERVOIR | 0.028 | 0.300 | 435.083 | 5.692 | 14.600 | 0.006 |
| 4917 | PIUTE RESERVOIR | 0.047 | 0.150 | 482.625 | 25.329 | 11.600 | 0.007 |
| 4918 | PORCUPINE RESERVOIR | 0.025 | 0.110 | 440.000 | 7.860 | 12.400 | 0.011 |
| 4919 | PRUESS RESERVOIR (GARRIS | 0.057 | 0.140 | 491.000 | 4.533 | 8.800 | 0.008 |
| 4920 | SEVIER BRIDGE RESERVOIR | 0.026 | 0.355 | 449.778 | 18.222 | 12.400 | 0.008 |
| 4921 | STARVATION RESERVOIR | 0.016 | 0.040 | 394.583 | 5.675 | 13.200 | 0.004 |
| 4922 | STEINAKER RESERVOIR | 0.011 | 0.040 | 316.750 | 1.844 | 12.600 | 0.005 |
| 4923 | TROPIC RESERVOIR | 0.021 | 0.050 | 425.000 | 7.200 | 8.400 | 0.006 |
| 4924 | UTAH LAKE | 0.132 | 0.320 | 490.583 | 72.012 | 11.400 | 0.012 |
| 4925 | WILLARD BAY RESERVOIR | 0.044 | 0.060 | 457.182 | 7.567 | 11.000 | 0.009 |
| 5605 | FLAMING GORGE RESERVOIR | 0.011 | 0.690 | 285.636 | 2.500 | 10.400 | 0.003 |

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500-MEAN SEC | MEAN CHLOR-A | 15-MIN DO | MEDIAN DISS ORTHO P | INDEX NO |
|---|---|---|---|---|---|---|---|---|
| 0408 | LAKE POWELL | 96 ( 25) | 4 ( 1) | 81 ( 21) | 73 ( 19) | 15 ( 4) | 42 ( 11) | 311 |
| 4901 | BEAR LAKE | 90 ( 23) | 87 ( 19) | 96 ( 25) | 100 ( 26) | 77 ( 20) | 90 ( 23) | 540 |
| 4902 | LOWER BOWN'S RESERVOIR | 46 ( 12) | 87 ( 19) | 85 ( 22) | 65 ( 17) | 73 ( 19) | 50 ( 13) | 406 |
| 4903 | DEER CREEK RESERVOIR | 42 ( 11) | 19 ( 5) | 42 ( 11) | 35 ( 9) | 0 ( 0) | 58 ( 14) | 196 |
| 4904 | ECHO RESERVOIR | 31 ( 8) | 27 ( 7) | 19 ( 5) | 50 ( 13) | 12 ( 3) | 13 ( 3) | 152 |
| 4905 | LYNN RESERVOIR | 8 ( 2) | 23 ( 6) | 58 ( 15) | 8 ( 2) | 62 ( 15) | 4 ( 1) | 163 |
| 4906 | FISH LAKE | 62 ( 16) | 65 ( 16) | 100 ( 26) | 23 ( 6) | 62 ( 15) | 79 ( 20) | 391 |
| 4907 | HUNTINGTON NORTH RESERVO | 77 ( 20) | 65 ( 16) | 69 ( 18) | 92 ( 24) | 96 ( 25) | 69 ( 18) | 468 |
| 4908 | JOE'S VALLEY RESERVOIR | 81 ( 21) | 58 ( 15) | 62 ( 16) | 85 ( 22) | 46 ( 12) | 96 ( 25) | 428 |
| 4909 | MINERSVILLE RESERVOIR | 0 ( 0) | 44 ( 11) | 27 ( 7) | 12 ( 3) | 85 ( 22) | 0 ( 0) | 168 |
| 4910 | MOON LAKE | 100 ( 26) | 87 ( 19) | 73 ( 19) | 77 ( 20) | 69 ( 18) | 100 ( 26) | 506 |
| 4911 | NAVAJO LAKE | 69 ( 18) | 87 ( 19) | 77 ( 20) | 88 ( 23) | 100 ( 26) | 85 ( 22) | 506 |
| 4912 | NEWCASTLE RESERVOIR | 23 ( 6) | 87 ( 19) | 46 ( 12) | 27 ( 7) | 19 ( 5) | 27 ( 7) | 229 |
| 4913 | OTTER CREEK RESERVOIR | 15 ( 4) | 87 ( 19) | 15 ( 4) | 31 ( 8) | 54 ( 14) | 8 ( 2) | 210 |
| 4914 | PANGUITCH LAKE | 12 ( 3) | 65 ( 16) | 50 ( 13) | 4 ( 1) | 8 ( 2) | 23 ( 6) | 162 |
| 4915 | PELICAN LAKE | 37 ( 9) | 54 ( 14) | 35 ( 9) | 54 ( 14) | 90 ( 23) | 73 ( 19) | 343 |
| 4916 | PINEVIEW RESERVOIR | 50 ( 13) | 15 ( 4) | 38 ( 10) | 58 ( 15) | 4 ( 1) | 58 ( 14) | 223 |
| 4917 | PIUTE RESERVOIR | 27 ( 7) | 31 ( 8) | 8 ( 2) | 15 ( 4) | 38 ( 10) | 46 ( 12) | 165 |
| 4918 | PORCUPINE RESERVOIR | 58 ( 15) | 38 ( 10) | 31 ( 8) | 38 ( 10) | 33 ( 8) | 19 ( 5) | 217 |
| 4919 | PRUESS RESERVOIR (GARRIS | 19 ( 5) | 35 ( 9) | 0 ( 0) | 69 ( 18) | 81 ( 21) | 37 ( 9) | 241 |
| 4920 | SEVIER BRIDGE RESERVOIR | 54 ( 14) | 8 ( 2) | 23 ( 6) | 19 ( 5) | 33 ( 8) | 37 ( 9) | 174 |
| 4921 | STARVATION RESERVOIR | 73 ( 19) | 87 ( 19) | 65 ( 17) | 62 ( 16) | 23 ( 6) | 79 ( 20) | 389 |
| 4922 | STEINAKER RESERVOIR | 85 ( 22) | 87 ( 19) | 88 ( 23) | 96 ( 25) | 27 ( 7) | 65 ( 17) | 448 |
| 4923 | TROPIC RESERVOIR | 65 ( 17) | 50 ( 13) | 54 ( 14) | 46 ( 12) | 90 ( 23) | 58 ( 14) | 363 |
| 4924 | UTAH LAKE | 4 ( 1) | 12 ( 3) | 4 ( 1) | 0 ( 0) | 42 ( 11) | 13 ( 3) | 75 |
| 4925 | WILLARD BAY RESERVOIR | 37 ( 9) | 44 ( 11) | 12 ( 3) | 42 ( 11) | 50 ( 13) | 31 ( 8) | 216 |
| 5605 | FLAMING GORGE RESERVOIR | 90 ( 23) | 0 ( 0) | 92 ( 24) | 81 ( 21) | 62 ( 15) | 90 ( 23) | 415 |

LAKES RANKED BY INDEX NOS.

| RANK | LAKE CODE | LAKE NAME | INDEX NO |
|---|---|---|---|
| 1 | 4901 | BEAR LAKE | 540 |
| 2 | 4911 | NAVAJO LAKE | 506 |
| 3 | 4910 | MOON LAKE | 506 |
| 4 | 4907 | HUNTINGTON NORTH RESERVO | 468 |
| 5 | 4922 | STEINAKER RESERVOIR | 448 |
| 6 | 4908 | JOE'S VALLEY RESERVOIR | 428 |
| 7 | 5605 | FLAMING GORGE RESERVOIR | 415 |
| 8 | 4902 | LOWER BOWN'S RESERVOIR | 406 |
| 9 | 4906 | FISH LAKE | 391 |
| 10 | 4921 | STARVATION RESERVOIR | 389 |
| 11 | 4923 | TROPIC RESERVOIR | 363 |
| 12 | 4915 | PELICAN LAKE | 343 |
| 13 | 0408 | LAKE POWELL | 311 |
| 14 | 4919 | PRUESS RESERVOIR (GARRIS | 241 |
| 15 | 4912 | NEWCASTLE RESERVOIR | 229 |
| 16 | 4916 | PINEVIEW RESERVOIR | 223 |
| 17 | 4918 | PORCUPINE RESERVOIR | 217 |
| 18 | 4925 | WILLARD BAY RESERVOIR | 216 |
| 19 | 4913 | OTTER CREEK RESERVOIR | 210 |
| 20 | 4903 | DEER CREEK RESERVOIR | 196 |
| 21 | 4920 | SEVIER BRIDGE RESERVOIR | 174 |
| 22 | 4909 | MINERSVILLE RESERVOIR | 168 |
| 23 | 4917 | PIUTE RESERVOIR | 165 |
| 24 | 4905 | LYNN RESERVOIR | 163 |
| 25 | 4914 | PANQUITCH LAKE | 162 |
| 26 | 4904 | ECHO RESERVOIR | 152 |
| 27 | 4924 | UTAH LAKE | 75 |

# APPENDIX B

## CONVERSION FACTORS

## CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x $8.107 \times 10^{-4}$ = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

# APPENDIX C

## TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR UTAH 10/18/76

LAKE CODE 4904 ECHO RES

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1895.9

| TRIBUTARY | SUB-DRAINAGE AREA(SQ KM) | NORMALIZED FLOWS(CMS) JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4904A1 | 1895.9 | 3.11 | 3.11 | 2.83 | 5.95 | 18.69 | 20.95 | 12.46 | 10.19 | 6.51 | 3.40 | 3.68 | 3.11 | 7.86 |
| 4904A2 | 1134.4 | 3.40 | 3.40 | 4.53 | 7.08 | 11.33 | 14.44 | 5.66 | 3.96 | 3.40 | 3.40 | 3.68 | 3.40 | 5.64 |
| 4904C1 | 655.3 | 0.54 | 0.59 | 0.99 | 3.17 | 7.33 | 4.45 | 1.10 | 0.57 | 0.48 | 0.51 | 0.57 | 0.54 | 1.74 |
| 4904D1 | 15.5 | 0.028 | 0.028 | 0.042 | 0.142 | 0.340 | 0.198 | 0.042 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.080 |
| 4904ZZ | 90.6 | 0.057 | 0.085 | 0.142 | 0.425 | 0.963 | 0.566 | 0.142 | 0.085 | 0.057 | 0.057 | 0.085 | 0.057 | 0.227 |

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1895.9
SUM OF SUB-DRAINAGE AREAS = 1895.9
TOTAL FLOW IN = 92.20
TOTAL FLOW OUT = 94.01

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 4904A1 | 11 | 74 | 0.651 | 10 | 0.623 | | | | |
| | 12 | 74 | 0.680 | 21 | 0.680 | | | | |
| | 1 | 75 | 0.680 | 4 | 0.680 | | | | |
| | 2 | 75 | 3.398 | 2 | 0.736 | | | | |
| | 3 | 75 | 4.814 | 23 | 5.663 | | | | |
| | 4 | 75 | 17.273 | 5 | 11.327 | | | | |
| | 5 | 75 | 14.442 | | | | | | |
| | 6 | 75 | 23.786 | | | | | | |
| | 7 | 75 | 22.087 | | | | | | |
| | 8 | 75 | 11.893 | | | | | | |
| | 9 | 75 | 13.309 | | | | | | |
| | 10 | 75 | 7.362 | | | | | | |
| 4904A2 | 11 | 74 | 5.125 | 10 | 5.097 | | | | |
| | 12 | 74 | 3.681 | 21 | 2.237 | | | | |
| | 1 | 75 | 4.021 | 4 | 2.350 | | | | |
| | 2 | 75 | 3.908 | 2 | 5.239 | | | | |
| | 3 | 75 | 3.936 | 23 | 3.879 | | | | |
| | 4 | 75 | 5.493 | 5 | 3.823 | | | | |
| | 5 | 75 | 7.844 | | | | | | |
| | 6 | 75 | 30.101 | | | | | | |
| | 7 | 75 | 19.029 | | | | | | |
| | 8 | 75 | 4.049 | | | | | | |
| | 9 | 75 | 4.078 | | | | | | |
| | 10 | 75 | 4.701 | | | | | | |

20

TRIBUTARY FLOW INFORMATION FOR UTAH 10/18/76

LAKE CODE 4904 ECHO RES

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 4904C1 | 11 | 74 | 0.765 | 10 | 0.708 | | | | |
| | 12 | 74 | 0.651 | 21 | 0.736 | | | | |
| | 1 | 75 | 0.623 | 4 | 0.566 | | | | |
| | 2 | 75 | 0.595 | 2 | 0.623 | | | | |
| | 3 | 75 | 0.934 | 23 | 0.963 | | | | |
| | 4 | 75 | 1.246 | 5 | 0.991 | | | | |
| | 5 | 75 | 7.985 | | | | | | |
| | 6 | 75 | 13.535 | | | | | | |
| | 7 | 75 | 3.851 | | | | | | |
| | 8 | 75 | 0.906 | | | | | | |
| | 9 | 75 | 1.189 | | | | | | |
| | 10 | 75 | 1.019 | | | | | | |
| 4904D1 | 11 | 74 | 0.028 | | | | | | |
| | 12 | 74 | 0.028 | | | | | | |
| | 1 | 75 | 0.028 | | | | | | |
| | 2 | 75 | 0.028 | | | | | | |
| | 3 | 75 | 0.042 | | | | | | |
| | 4 | 75 | 0.057 | | | | | | |
| | 5 | 75 | 0.368 | | | | | | |
| | 6 | 75 | 0.623 | | | | | | |
| | 7 | 75 | 0.170 | | | | | | |
| | 8 | 75 | 0.042 | | | | | | |
| | 9 | 75 | 0.057 | | | | | | |
| | 10 | 75 | 0.042 | | | | | | |
| 4904ZZ | 11 | 74 | 0.113 | | | | | | |
| | 12 | 74 | 0.085 | | | | | | |
| | 1 | 75 | 0.085 | | | | | | |
| | 2 | 75 | 0.085 | | | | | | |
| | 3 | 75 | 0.113 | | | | | | |
| | 4 | 75 | 0.170 | | | | | | |
| | 5 | 75 | 1.048 | | | | | | |
| | 6 | 75 | 1.756 | | | | | | |
| | 7 | 75 | 0.510 | | | | | | |
| | 8 | 75 | 0.113 | | | | | | |
| | 9 | 75 | 0.142 | | | | | | |
| | 10 | 75 | 0.142 | | | | | | |

# APPENDIX D

## PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/12

490401
40 57 51.0 111 25 37.0 3
ECHO RESERVOIR
49043 UTAH

11EPALES 2111202
0072 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75/05/12 | 15 15 | 0000 | 9.3 | 10.4 | 24 | 455 | 8.50 | 250 | 0.030 | 0.700 | 0.060 | 0.017 |
| | 15 15 | 0005 | 9.3 | 10.4 | | 456 | 8.50 | 246 | 0.020 | 0.400 | 0.060 | 0.016 |
| | 15 15 | 0015 | 6.9 | 10.0 | | 454 | 8.35 | 266 | 0.020 | 0.300 | 0.110 | 0.016 |
| | 15 15 | 0035 | 6.8 | 9.2 | | 451 | 8.30 | 222 | 0.040 | 0.400 | 0.130 | 0.025 |
| | 15 15 | 0068 | 6.6 | 9.4 | | 451 | 8.40 | 198 | 0.050 | 0.400 | 0.160 | 0.017 |
| 75/08/07 | 16 05 | 0000 | 21.5 | 6.8 | 72 | 297 | 8.90 | 150 | 0.280 | 0.300 | 0.020K | 0.006 |
| | 16 05 | 0005 | 19.3 | 4.8 | | 289 | 8.50 | 152 | 0.100 | 0.300 | 0.020 | 0.006 |
| | 16 05 | 0015 | 17.5 | 4.4 | | 281 | 8.40 | 154 | 0.250 | 0.300 | 0.050 | 0.005 |
| | 16 05 | 0030 | 16.2 | 4.4 | | 273 | 8.35 | 150 | 0.140 | 0.300 | 0.120 | 0.005 |
| | 16 05 | 0060 | 13.1 | 3.8 | | 265 | 8.45 | 156 | 0.200 | 0.400 | 0.230 | 0.031 |
| | 16 05 | 0080 | 10.3 | 1.0 | | 291 | 8.20 | 181 | 0.530 | 0.600 | 0.260 | 0.170 |
| 75/09/18 | 15 50 | 0000 | 14.3 | 6.8 | 72 | 337 | 8.50 | 171 | 0.020K | 0.300 | 0.060 | 0.005 |
| | 15 50 | 0005 | 14.2 | 6.2 | | 310 | 8.40 | 170 | 0.020K | 0.300 | 0.060 | 0.006 |
| | 15 50 | 0024 | 13.9 | 4.8 | | 333 | 8.10 | 172 | 0.020K | 0.200 | 0.130 | 0.014 |
| | 15 50 | 0045 | 13.3 | 1.6 | | 338 | 7.95 | 174 | 0.020K | 0.400 | 0.180 | 0.027 |
| | 15 50 | 0071 | 13.0 | 2.8 | | 330 | 7.90 | 175 | 0.030 | 0.400 | 0.200 | 0.024 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 75/05/12 | 15 15 | 0000 | 0.051 | 8.5 | |
| | 15 15 | 0005 | 0.048 | | |
| | 15 15 | 0015 | 0.036 | | |
| | 15 15 | 0035 | 0.035 | | |
| | 15 15 | 0068 | 0.056 | | |
| 75/08/07 | 16 05 | 0000 | 0.024 | 4.2 | |
| | 16 05 | 0005 | 0.029 | | |
| | 16 05 | 0015 | 0.021 | | |
| | 16 05 | 0030 | 0.016 | | |
| | 16 05 | 0060 | 0.044 | | |
| | 16 05 | 0080 | 0.199 | | |
| 75/09/18 | 15 50 | 0000 | 0.043 | 2.6 | |
| | 15 50 | 0005 | 0.038 | | |
| | 15 50 | 0024 | 0.070 | | |
| | 15 50 | 0045 | 0.137 | | |
| | 15 50 | 0071 | 0.079 | | |

K VALUE KNOWN TO BE

STORET RETRIEVAL DATE 76/08/12

490402
40 56 13.0 111 24 12.0 3
ECHO RESERVOIR
49043 UTAH

11EPALES 2111202
0011 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75/05/12 | 15 | 35 0000 | 9.6 | 10.0 | 14 | 502 | 8.50 | 197 | 0.030 | 0.600 | 0.060 | 0.021 |
| | 15 | 35 0005 | 9.3 | 9.6 | | 502 | 8.45 | 188 | 0.040 | 0.500 | 0.130 | 0.041 |
| 75/08/07 | 16 | 20 0000 | 22.0 | 6.6 | 72 | 297 | 8.60 | 149 | 0.140 | 0.400 | 0.020K | 0.012 |
| | 16 | 20 0005 | 21.9 | 7.4 | | 292 | 8.85 | 140 | 0.160 | 0.500 | 0.020 | 0.006 |
| | 16 | 20 0015 | 21.3 | 11.2 | | 293 | 8.89 | 144 | 0.170 | 0.500 | 0.020K | 0.006 |
| | 16 | 20 0028 | 17.3 | 5.6 | | 295 | 8.45 | 157 | 0.230 | 0.600 | 0.100 | 0.009 |
| 75/09/18 | 16 | 15 0000 | 14.9 | 7.6 | 44 | 339 | 8.30 | 172 | 0.030 | 0.200 | 0.040 | 0.007 |
| | 16 | 15 0005 | 14.9 | 7.8 | | 341 | 8.40 | 173 | 0.030 | 0.200 | 0.030 | 0.006 |
| | 16 | 15 0011 | 14.9 | 7.4 | | 340 | 8.40 | 172 | 0.030 | 0.200 | 0.030 | 0.006 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L | 00031 INCDT LT REMNING PERCENT |
|---|---|---|---|---|---|
| 75/05/12 | 15 | 35 0000 | 0.083 | 13.4 | |
| | 15 | 35 0005 | 0.144 | | |
| 75/08/07 | 16 | 20 0000 | 0.033 | 4.7 | |
| | 16 | 20 0005 | 0.026 | | |
| | 16 | 20 0015 | 0.025 | | |
| | 16 | 20 0028 | 0.047 | | |
| 75/09/18 | 16 | 15 0000 | 0.049 | 8.4 | |
| | 16 | 15 0005 | 0.050 | | |
| | 16 | 15 0011 | 0.049 | | |

K VALUE KNOWN TO BE
LESS THAN INDICATED

# APPENDIX E

## TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/08/12

4904A1
41 58 00.0 111 26 10.0 4
WEBER RIVER
49 7.5 COALVILLE
O/ECHO RESERVOIR 150791
GAGE STATN .5 MI BELOW ECHO DAM
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/11/10 | 10 35 | | 0.085 | 0.800 | 0.055 | 0.023 | 0.030 |
| 74/12/21 | 07 30 | | 0.112 | 0.500 | 0.025 | 0.010 | 0.030 |
| 75/01/04 | 13 15 | | 0.232 | 0.400 | 0.015 | 0.020 | 0.060 |
| 75/02/02 | 12 45 | | 0.152 | 0.400 | 0.088 | 0.024 | 0.050 |
| 75/03/23 | 11 00 | | 0.165 | 0.300 | 0.050 | 0.015 | 0.030 |
| 75/04/05 | 11 30 | | 0.150 | 0.550 | 0.070 | 0.010 | 0.060 |
| 75/05/14 | 09 30 | | 0.110 | 1.100 | 0.300 | 0.007 | 0.030 |

STORET RETRIEVAL DATE 76/08/12

4904A2
40 53 49.0 111 24 05.0 4
WEBER RIVER
49 7.5 COALVILLE
T/ECHO RESERVOIR
BRDG ON LGHT DTY RD 1.5 M S OF COALVILLE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/11/10 | 11 40 | | 0.120 | 0.900 | 0.055 | 0.022 | 0.030 |
| 74/12/21 | 09 00 | | 0.248 | 2.000 | 0.027 | 0.020 | 0.030 |
| 75/01/04 | 14 00 | | 0.200 | 0.500 | 0.045 | 0.025 | 0.030 |
| 75/02/02 | 13 30 | | 0.192 | 0.200 | 0.024 | 0.016 | 0.030 |
| 75/03/23 | 12 00 | | 0.230 | 0.450 | 0.030 | 0.015 | 0.070 |
| 75/04/05 | 13 00 | | 0.190 | 0.600 | 0.055 | 0.015 | 0.080 |
| 75/05/14 | 11 00 | | 0.250 | 2.400 | 0.045 | 0.055 | |

STORET RETRIEVAL DATE 76/08/12

4904C1
40 55 14.0 111 24 07.0 4
CHALK CREEK
49 7.5 COALVILLE
T/ECHO RESERVOIR
US 189 BRDG .2 MI N OF JCT # ST RT 133
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/11/10 | 10 55 | | 0.288 | 0.900 | 0.030 | 0.010 | 0.010 |
| 74/12/21 | 08 00 | | 0.336 | 1.800 | 0.025 | 0.005 | 0.020 |
| 75/01/04 | 13 30 | | 0.384 | 0.300 | 0.005 | 0.005 | 0.010 |
| 75/02/02 | 13 00 | | 0.330 | 0.200 | 0.016 | 0.016 | 0.020 |
| 75/03/23 | 11 30 | | 0.200 | 0.200 | 0.020 | 0.010 | 0.070 |
| 75/04/05 | 12 00 | | 0.080 | 0.400 | 0.020 | 0.005K | 0.060 |
| 75/05/14 | 10 20 | | 0.420 | 2.400 | 0.140 | 0.050 | |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

490401
40 55 13.0 111 24 42.0 4
UNNAMED STREAM
49 7.5 COALVILLE
T/ECHO RESERVOIR
BRDG ON LGHT DTY RD 2 MI W OF COALVILLE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 74/11/10 | 12 05 | | 1.280 | 0.600 | 0.020 | 0.050 | 0.060 |
| 74/12/12 | 09 30 | | 1.360 | 0.400 | 0.020 | 0.085 | 0.110 |
| 75/01/04 | 14 40 | | 1.320 | 0.400 | 0.020 | 0.070 | 0.130 |
| 75/02/02 | 14 15 | | 0.850 | 0.500 | 0.040 | 0.080 | 0.180 |
| 75/03/23 | 12 15 | | 1.400 | 0.400 | 0.015 | 0.055 | 0.230 |
| 75/04/20 | 13 30 | | 1.250 | 0.950 | 0.135 | 0.045 | 0.150 |
| 75/05/14 | 11 30 | | 1.350 | 2.200 | 0.155 | 0.005 | 0.040 |

STORET RETRIEVAL DATE 76/08/12

490421 TF490421 P001000
40 56 00.0 111 24 00.0 4
COALVILLE
49 7.5 COALVILLE
D/ECHO RES.
ECHO RES.
11EPALES 2141204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P | 50051 FLOW RATE INST MGD | 50053 CONDUIT FLOW-MGD MONTHLY |
|---|---|---|---|---|---|---|---|---|---|
| 75/01/15 | 15 | 35 | 0.400 | 24.000 | 0.400K | 4.800 | 8.400 | 0.150 | 0.600 |
| 75/04/10 | 12 | 30 | 0.300 | 28.000 | 9.100 | 3.400 | 9.800 | 0.050 | 0.650 |
| 75/05/02 | 14 | 40 | 0.350 | 27.000 | 5.750 | 3.750 | 11.000 | 0.600 | 0.700 |
| 75/05/29 | 15 | 00 | 0.600 | 15.500 | 3.600 | 2.200 | 10.000 | 0.750 | 0.650 |
| 75/06/24 | 19 | 30 | 2.750 | 8.500 | 0.025K | 1.700 | 3.500 | 0.670 | 0.650 |
| 75/07/02 | 14 | 30 | 1.000 | 9.795 | 0.025K | 1.350 | 2.050 | 0.800 | |
| 75/09/09 | 14 | 00 | 1.700 | 8.700 | 0.025K | 1.880 | 4.800 | 0.432 | 0.432 |
| 75/10/30 | 12 | 00 | 1.300 | 21.000 | 5.500 | 4.000 | 6.600 | 0.100 | 0.100 |
| 75/12/16 | 12 | 00 | 0.900 | 26.000 | 9.600 | 3.750 | 8.000 | 0.270 | 0.260 |

K VALUE KNOWN TO BE
LESS THAN INDICATED